

Image: Redfin



Image: Camp Hadar



Image: Compass



# Captains Pond Watershed Management Plan

Salem, New Hampshire  
Public Kickoff Meeting



**Captains Pond  
Protective  
Association**



December 9, 2025

A photograph of a lake with a small blue boat in the foreground. The background shows a dense forest and a clear blue sky with scattered clouds.

# AGENDA

01

**Project Introduction**

02

**Water Quality History**

03

**Project Task Summary**

01

# Project Introduction

Weston & Sampson<sup>SM</sup>



## Project Funding Source

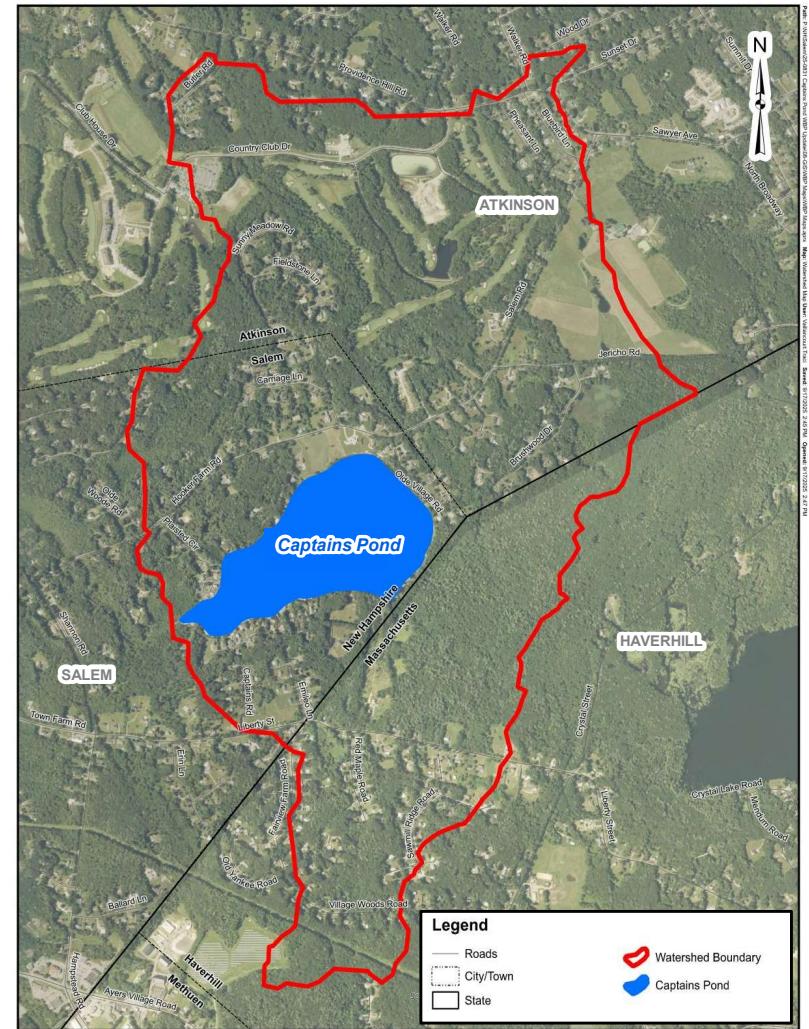
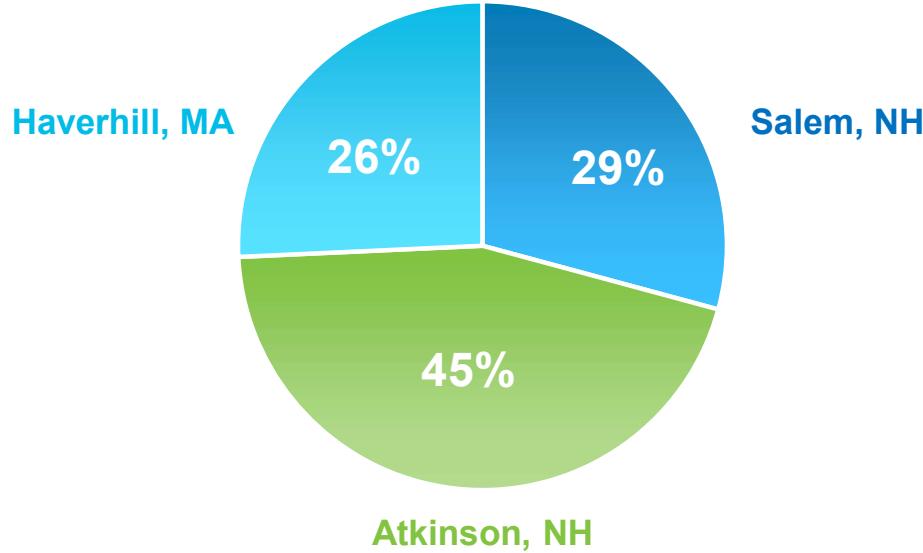
- The **Clean Water State Revolving Fund (CWSRF)** provides low-cost financial assistance for planning, design, and construction projects to communities, nonprofits, and other local government entities.
- Under the 2020 CWSRF program, Salem prepared a Preliminary Watershed Based Plan (WBP) and Phosphorus Source Identification Report (PSIR) for Captains Pond.
  - Preliminary WBP only considered portions of the WBP specific to Salem.
- The Town of Salem, NH was awarded \$100,000 from NHDES through the CWSRF Program for the expansion of the Preliminary WBP to consider all watershed municipalities (Salem, Atkinson, Haverhill).



# Captains Pond Watershed

1,142-acre watershed

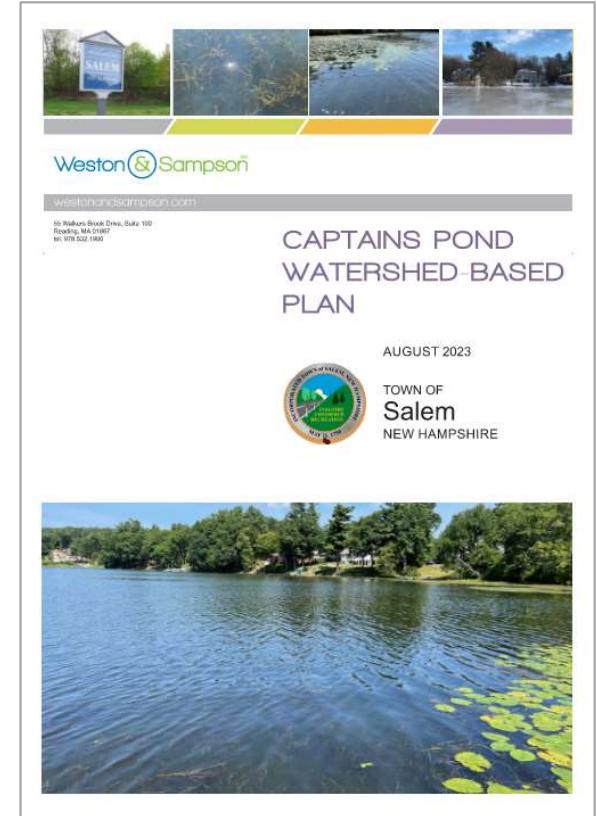
## Captains Pond Watershed Area



## Preliminary Watershed Based Plan (WBP) and Phosphorus Source Identification Report (PSIR)

- Initial In-Lake Water Quality Data Review
- Salem, NH Watershed Land Use Analysis
- In-Lake sampling and Vegetation Survey
- Identification of SCM opportunities in Salem
- Two Public Meetings

psir



## Watershed Management Plan



Identify and quantify **pollutant sources**



Determine potential **solutions**



Develop plan to **implement**



Develop plan to **reassess**

## Nonpoint Source (NPS) Pollution

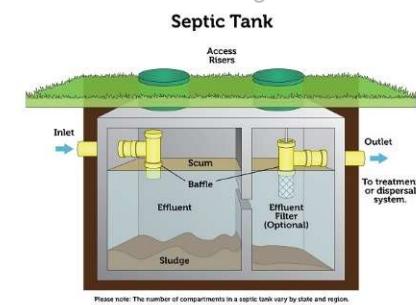
- NPS discharge **indirectly** to waterways
  - Lawn care
  - Winter road maintenance
  - Urban runoff
  - Forestry
  - Septic leaks
  - Agriculture runoff
  - Marinas and boating
  - Pet/animal waste
  - Leaf litter
  - Construction erosion



Source: yardcare.com



Source: nhlakes.org



Source: epa.gov



Source: epa.gov



Source: weforum.org



Source: des.nh.gov



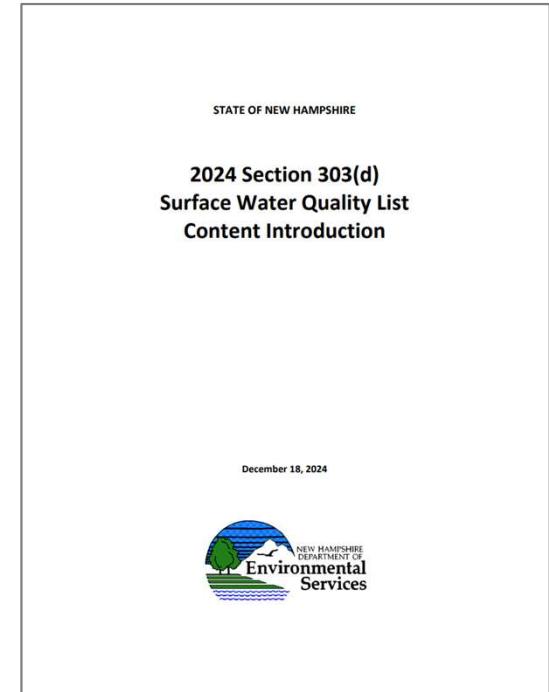
Source: shilohsvet.com



Source: usgs.gov

## Water Quality Impairments

- **Impairments:**
  - *E. coli*
  - Total Phosphorus
  - Dissolved Oxygen
- **Total Maximum Daily Load (TMDL)** for Phosphorus for Captains Pond (September 2017)
  - A TMDL identifies the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards



The **Section 303(d) List** identifies surface waters impaired or threatened by pollutants

## What is cyanobacteria?

- **Cyanobacteria (blue-green algae)** are microscopic organisms found in lakes, rivers, and oceans.
- Excessive growth can lead to harmful blooms, impacting aquatic ecosystems.
- Some cyanobacteria produce toxins, known as **cyanotoxins**, that can negatively impact human health.
  - Can cause nausea, vomiting, diarrhea, mild fever, skin rashes, eye and nose irritations, numbness and general malaise.



Source: epa.gov



Source: des.nh.gov

## Cyanobacteria Bloom History

Identifier: Captains.Salem

NHDES

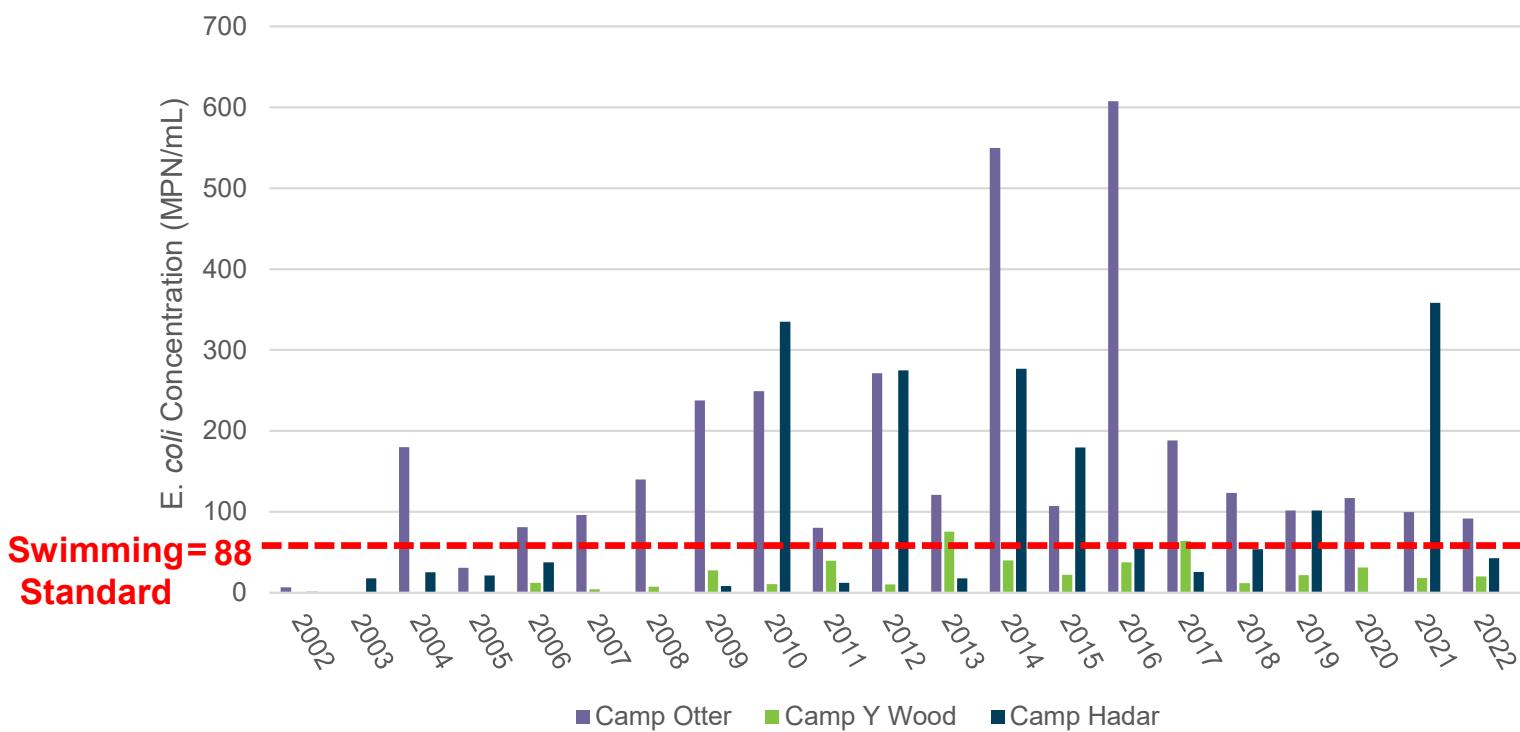
Updated: March 27, 2025

Cyanobacteria warnings are issued from May 15 to October 15. Watches are issued year-round.

Type of Notification	Date Issued	Date Removed	# of Days Issued	Dominant Taxa	Initial Cyanobacteria Cell Density (cells/mL)
Warning	6/20/2019	7/2/2019	12	<i>Anabaena/Dolichospermum</i>	6,250,000
Watch	7/7/2022	**	**	**	**
Warning	9/14/2022	9/29/2022	15	<i>Dolichospermum</i>	76,000
Warning	8/4/2023	8/18/2023	14	<i>Planktothrix, Aphanizomenon</i>	too numerous to count (TNTC)
Watch	5/21/2024	5/28/2024	7	<i>Dolichospermum</i>	6,667

## Bacteria

E. coli Concentrations at Swimming Beaches at Captains Pond, 2002-2022



**Eight (8) beach fecal bacteria advisories since 2015**

- Camp Hadar: 1
- Camp Otter: 6
- Camp Y Wood: 1

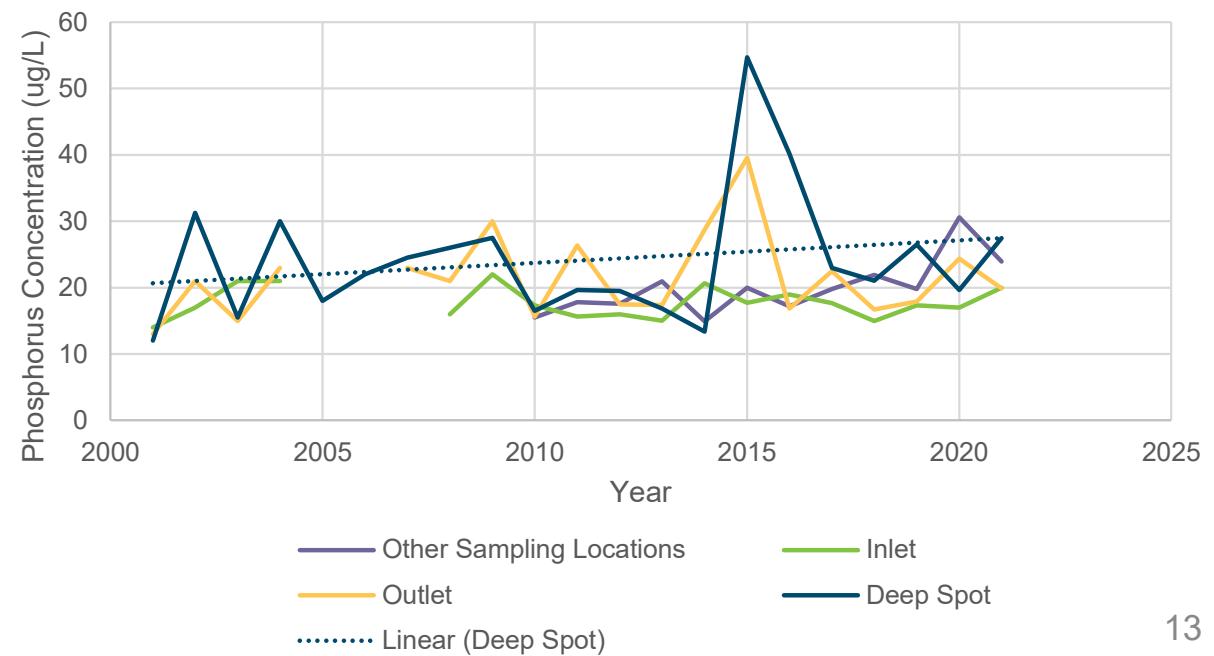


Source: meredithnh.gov

## Total Phosphorus

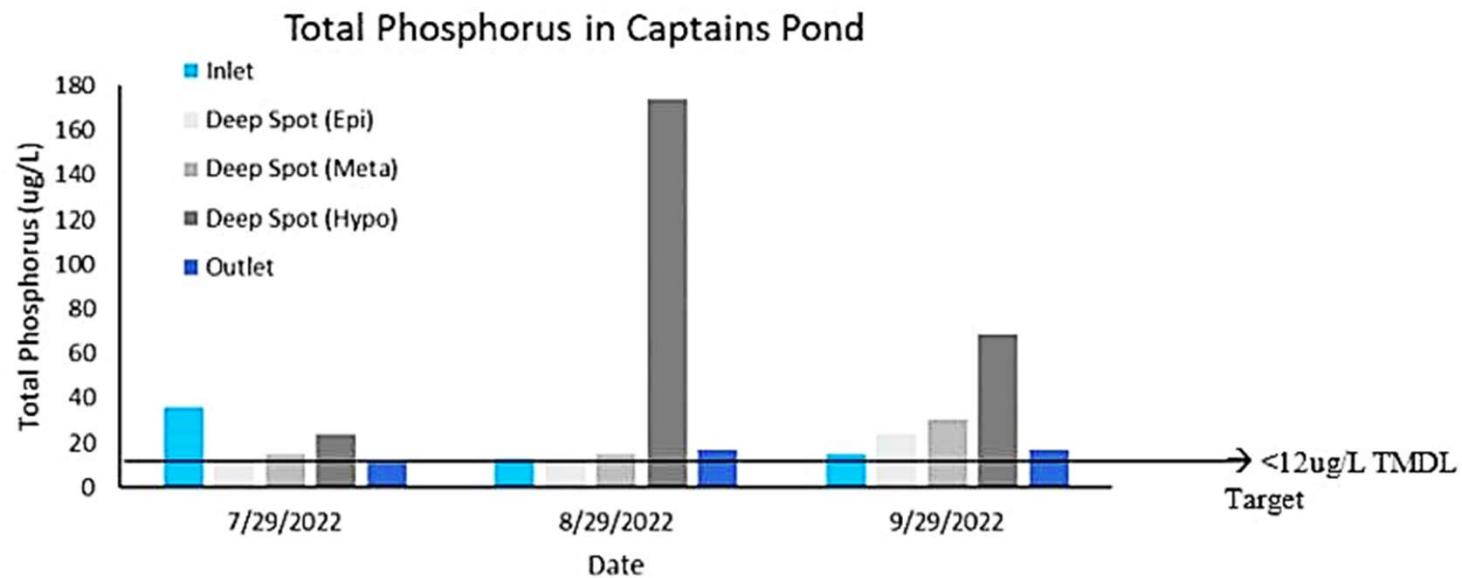
- Total phosphorus concentrations and number of cyanobacteria advisories are **increasing**

Historical In-Lake Phosphorus Concentrations at Captains Pond, 2001-2021



## Water Quality Snapshot – Summer 2022

- Water chemistry, algae, and sediment samples collected July-Sept 2022
  - Nutrient levels in Captains Pond are rising, increasing algae and plant growth
  - In-lake and external nutrient loading is likely occurring



## Ongoing and Completed Field Work

- Dry-weather outfall inspections & sampling completed in Winter 2021
- Wet-weather outfall sampling completed March 2022
- Catchment investigations began in 2020 and are ongoing
- Vegetation survey & in-pond water quality sampling July to Sept. 2022



## Addressing Lake Pollution

- Structural Stormwater Control measures (SCMs)
- Non-structural practices
  - Street sweeping
  - Catch basin cleaning
  - Leaf litter collection
  - Stormwater education (pet waste, lawn fertilizer)
  - Septic system education

### Structural Stormwater Control Measures

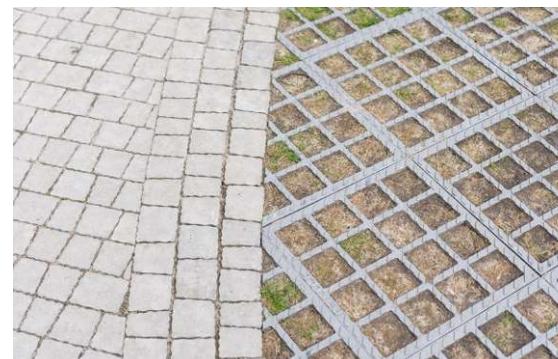


Bioretention/Rain Garden

Source: [www.epa.gov](http://www.epa.gov)



Wet Pond  
326 N Broadway



Permeable Pavement

Source: [www.epa.gov](http://www.epa.gov)

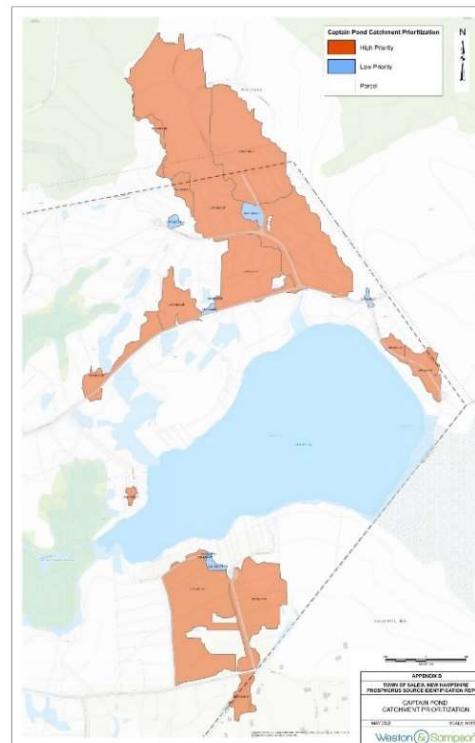


Bioswale  
7 Millville Drive

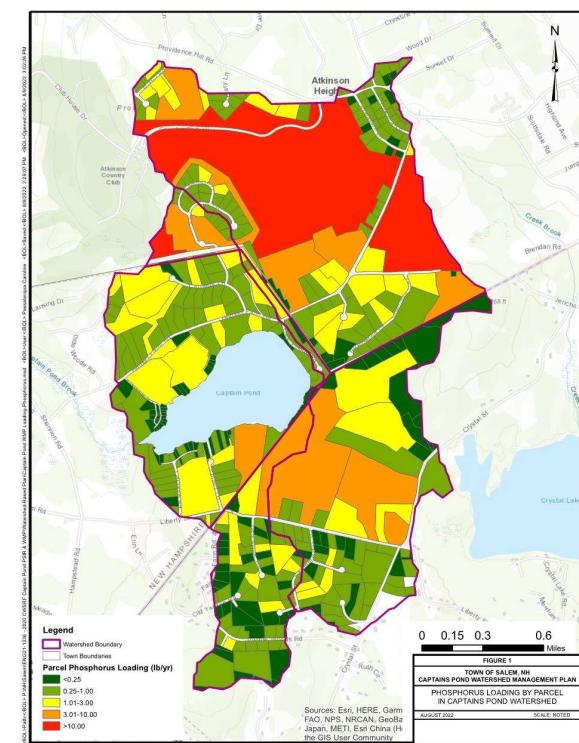
## Identified Sources in the Watershed

- Stormwater runoff from high priority parcels and right-of-way areas
- Identified using NHDES Hot Spot data and land use/land cover data from Massachusetts
- Waterfowl loading
- Septic system loading

High-Priority Catchment Areas for Phosphorus Loading

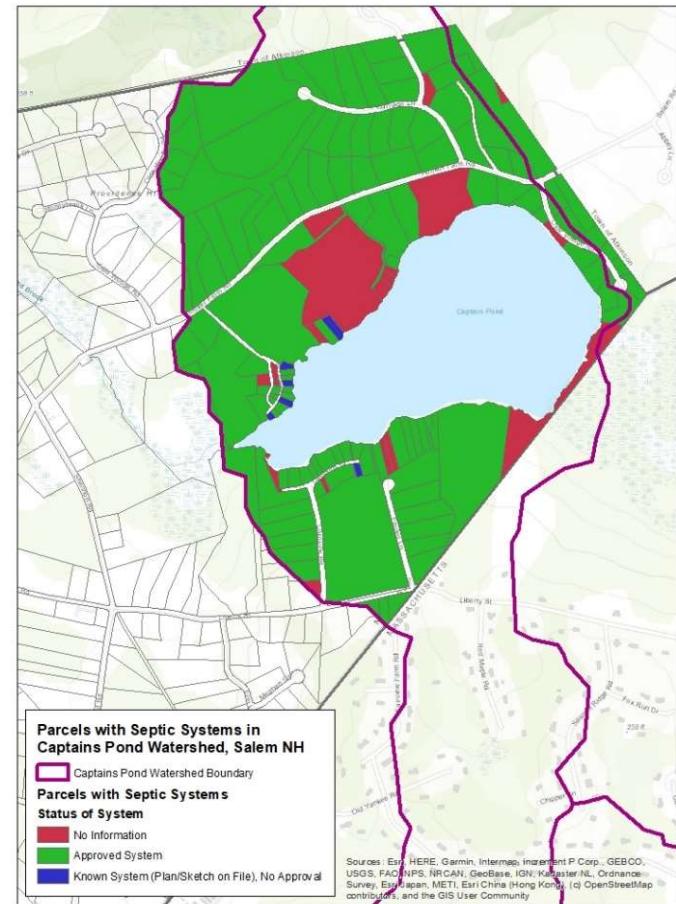


Phosphorus Hot Spot Parcel Map



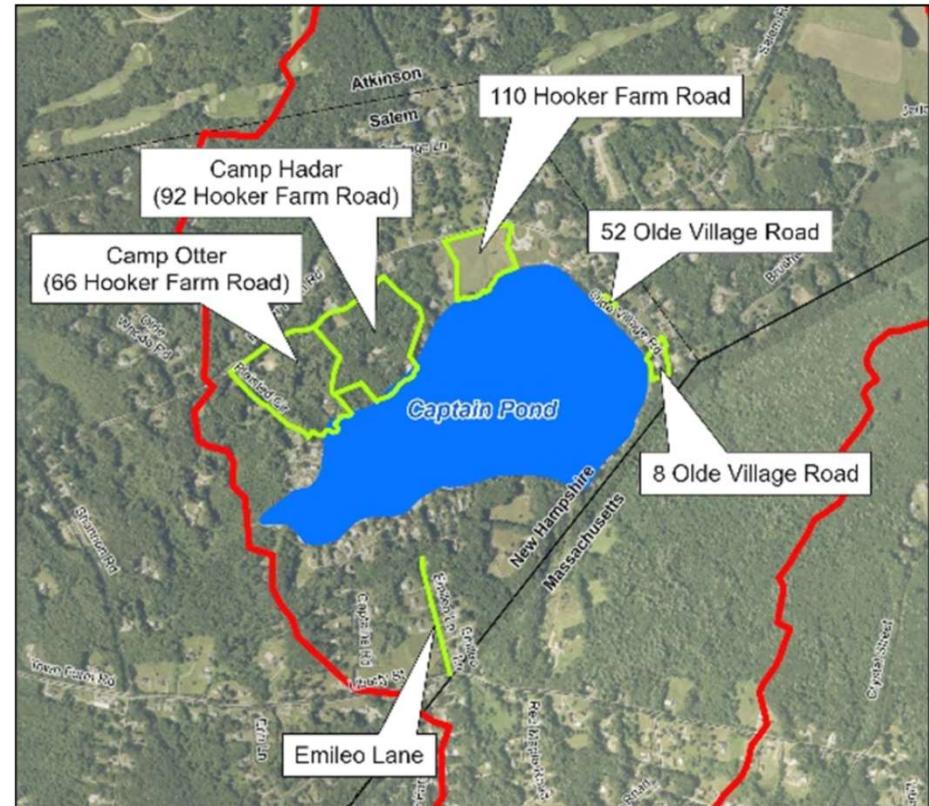
## Septic System Monitoring

- Only one record of a failed system since 1990; system was replaced
- Need to expand inventory to include parcels in Atkinson and Haverhill, MA



## Potential Structural SCM Locations

- 8 Olde Village Road
- 52 Olde Village Road right-of-way
- Camp Hadar and Camp Otter
- 110 Hooker Farm Road
- Emileo Lane cul-de-sac



## Existing Structural Stormwater Control measures (SCMs)

- Captains Drive Rain Garden (2018)
  - Updates to drainage infrastructure
  - Bioretention area installed downstream of outfall
- Plaisted Circle Drainage Improvements (2020)
  - Updates to drainage infrastructure
  - Removal of two direct stormwater discharges
  - Rerouting of stormwater to a wetland area



Rain garden located at 7 Captains Dr

## Watershed Management Plan



Identify and quantify **pollutant sources**



Determine potential **solutions**



Develop plan to **implement**



Develop plan to **reassess**

## EPA's Nine Required Elements



POLLUTANT SOURCE  
IDENTIFICATION



ESTIMATED LOAD  
REDUCTIONS



MANAGEMENT MEASURES



COST & TECHNICAL  
ASSISTANCE ESTIMATE



EDUCATION & OUTREACH



IMPLEMENTATION  
SCHEDULE



MEASURABLE MILESTONES



EVALUATION CRITERIA



LONG-TERM MONITORING

Task 1 Project Management

Task 2 Draft Site-Specific Project Plan (SSPP)

Task 3 Data Review

Task 4 Establish Water Quality Goal

Task 5 Pollutant Load Modeling

Task 6 Assess Stormwater Treatment Methods

Task 7 Update Preliminary WBP

Task 8 Preliminary SCM Design

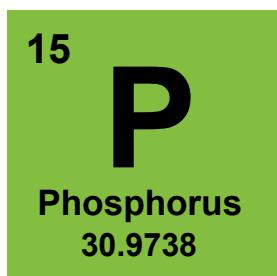
- **Task 1 – Project Management**
  - Establish Steering Committee
  - Progress Updates
- **Steering Committee Role**
  - Attend monthly meetings
  - Provide input on key aspects of the WBP including the water quality goal and locations for the SCMs.
  - Provide input on the plan from a local perspective



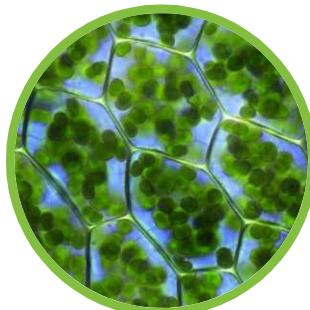
- **Task 2 – Site Specific Project Plan (SSPP)**
  - Review by NHDES
  - Finalize SSPP



- **Task 3 – Data Review**
  - Total Phosphorus <sup>(1)</sup>
  - Chlorophyll-a <sup>(2)</sup>
  - Dissolved Oxygen <sup>(3)</sup>
  - Secchi Disk Transparency <sup>(4)</sup>
  - Outfall Data <sup>(5)</sup>



(1)



(2)



(3)



(4)



(5)

26

## • **Task 4 – Establish Water Quality Goal**

- Established by the Steering Committee
- Based on the water quality analysis
- Actions that may be proposed to work towards meeting goal:
  - Waterfowl management
  - Watershed load control
    - SCM retrofits
    - Nonstructural practice changes
  - Wetland restoration/preservation
  - Land Use ordinance updates
    - Prevent future loading



**In-lake Total Phosphorus Concentration Goal**

- **Task 5 – Pollutant Load Modeling**

Develop Existing Conditions Model

Calculate pollutant loading  
Calculate in-pond WQ

Calibrate

Based on available data

Load Reduction Analysis

Determine reductions needed to meet WQ goal

Lake Loading Response Model (LLRM)

**LLRM method depicts:**

- Background conditions
- Current in-pond conditions

## Lake Loading Response Model (LLRM, also called SHEDMOD or ENSR-LRM)

- Developed by the consulting firm AECOM for use in New England and modified for New Hampshire lakes
- Excel-based model that uses environmental data to develop a water and nutrient loading budget for lakes/ponds and their tributaries
- Used for TP loading assessment in Captains Pond TMDL
  - Comparison of TMDL model output with the project model run

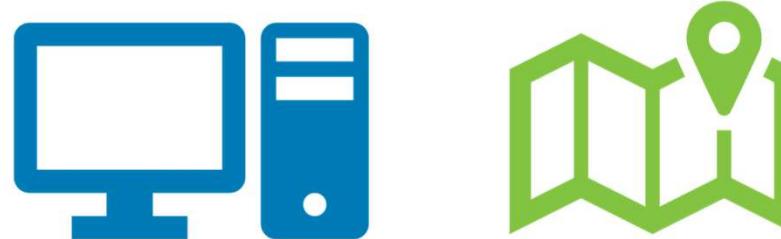
- **Task 6 – Assess Stormwater Treatment Methods**
  - Watershed Field Assessment
    - Identification of potential sites for SCMs
      - Desktop/GIS analysis
      - Field investigations
      - Build off of preliminary plan



- **Task 7 – Update Preliminary WBP**
  - Expand to include Atkinson & Haverhill areas
  - Update Action Plan
    - Potential Funding Sources
    - Required Regulatory Updates
    - Implementation Schedule / Milestones
    - Progress Indicators
  - Undergo NHDES Review



- **Task 8 – Preliminary Stormwater Control Measure (SCM) Design**
  - Desktop analysis for up to three (3) proposed locations
  - 30% design drawing for the most favorable site



# Thank you! Questions?

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